Computer Architecture

Fall, 2019

Week 2

2020.9.21

Group:

組員簽名：_____

[group2] (對抗賽)

1. Computer A has an overall CPI of 1.5 and can be run at a clock rate of 700MHz. Computer B has a CPI of 2.0 and can be run at a clock rate of 650MHz. We have a particular program to run and this program has exactly 120 instructions when compiled for computer A. How many instructions would the program need to have when compiled for Computer B if we want the two computers to have exactly the same execution time for this program?

Ans :

Suppose IC_B represents instruction count for Computer B

Execution time for Computer A= Execution time for Computer B

=> (120 * 1.5) / 700M = (IC_B * 2) / 650M => IC_B = 835.7 approximate to 836

[group4] (對抗賽)

2. Which following description is correct ?

(A) Embedded computer requires high security.

(B) The improvement factor affects the total cost time.

(C) Instruction Count for a program is determined by program, ISA and compiler.

(D) Execution time can calculate with Elapsed time or CPU time. Depend on the CPU time, we can compare the total performance of the different systems.

Ans :

Answer: (C)

(A) Server computer requires high security.

(B) The improvement factor only affects parts of the total cost time (affected time)

(D) depend on Elapsed time

[group12] (對抗賽)

3. A processor has a clock rate of 500MHz, and the following measurements have been made using a simulator. ($\sum Ratio = 1$)

Instruction class	CPI	Ratio
A	2	40%
B	3	25%
C	3	25%
D	3	10%

Later the compiler of the processor was improved to enhance the performance. The instruction improvements from this enhanced compiler have been estimated as follows. Please calculate the speedup compared to the old compiler.

Instruction class	% of instruction executed vs. old compiler
A	90%
B	80%
C	85%
D	90%

Ans :

Avg. CPI of old processor: 2*0.4 + 3*0.25 + 3*0.25 + 3*0.1 = 2.6

Avg. CPI of new processor: (2*0.4*0.9 + 3*0.25*0.8 + 3*0.25*0.85 + 3*0.1*0.9) / (0.9*0.4 + 0.8*0.25 +0.85*0.25 +0.1*0.9) = 2.5826

Speedup: 2.6/(0.8625*2.5826) = 1.167

[group13] (對抗賽)

4. Which of the following statements are true about Moore's law?
   (a) It states the minimum feature size will decrease 2 times every 1.5 years.
   (b) It states the number of transistors will increase 2 times every 1.5 years.
   (c) Moore's law states that the speed and capacity of computers will increase are expectable.
   (d) It states the efficiency of CPU will increase is expectable.

Ans :

(b) and (c)

(a) is wrong since Moore's law states about the number of transistors, not the minimum feature size.

(d) is wrong since the law talks about the tend of transistors' progress, not CPU.

[group3]

5. 電腦 A： clock rate 為 8GHz，執行某程式花了 20 秒 CPU time
   電腦 B： 執行同樣程式花 80 秒的 CPU time，且電腦 B 所花費的 clock cycles 為電腦 A 的 1.6 倍
   請問電腦 B 的 clock rate 為何？

Ans:

$$\text{clock rate}_B = \text{clock cycle}_B \div \text{CPU time}_B$$
$$= 1.6 \text{ clock cycle}_A \div 80$$
$$= 1.6 \times 8G \times 20 \div 80$$
$$= 1.6 \times (8 \times 10^9) \times 20 \div 80$$
$$= 1.6 \times 2 \times 10^9$$
$$= 3.2G \text{ (單位: Hz)}$$

[group8] (對抗賽)

6. 公司要求下一版本的 APP 性能需提升至 2 倍（即 Time_old/Time_new = 2），你已經確定只有 80% 的部分可以變動。那麼，這部分需要改進多少（也就是說 Improvement factor 應該是多少？）才能達到整體性能指標？

$$\frac{80}{x} + 20 = 50$$
$$\frac{80}{x} = 30$$
$$x = \frac{8}{3} = 2.67$$

[group6] (對抗賽)

7. CPU time 是用來衡量電腦執行效能的一種方式，CPU time 的公式為:

CPU clock cycles x Clock cycle time

若是為了增加效能，減少 Clock cycle time 是否一定可以使 CPU time 減少? 若否，則原因為何?

A:

減少 cycle time 不一定可以使 CPU time 變短。因為在 cycle time 變短的同時 一個 cycle 內能做的指令也變少了，等於需要更多的 cycle 才能做完，因為這樣 導致 CPU time 不一定會變短。

[group11] (對抗賽)

8. 某支程式由以下三種類型的 instructions (A, B, C)組成，它們分別有自己的 CPI 和 Instruction counts

	A	B	C
CPI	1	4	2
Instruction Counts (In billion)	2	2	4

假設這支程式在一顆 clock rate 4GHz 的 CPU 上執行，

假設這顆 CPU 做了改進之後使得三種 instructions 的 CPI 變成

	A	B	C
New CPI	1	2	2

在同樣一支程式上，這個改進能將效能提升多少倍(Speedup)?